

## Methods and Apparatus for Correction of Urinary and Gynecological Pathologies, including Treatment of Male Incontinence, and Female Cystocele

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### Field of the Invention

The present invention relates to methods and devices for treatment of urinary pathologies.

### Background

Male incontinence is a condition characterized by involuntary loss of urine, beyond the individual's control. One cause for this condition is damage to the urethral sphincter, such as can occur after prostatectomy, after radiation or after pelvic accidents. Other accepted reasons for male incontinence include bladder instability, over-flowing incontinence and fistulas.

The present application is directed to the treatment of male urinary incontinence which is related to urethral sphincter damage. Currently, the treatment of choice involves implantation of a Kaufman Prosthesis, an artificial sphincter (such as AMS-800), and a sling procedure in which a sling is inserted beneath the urethra and advanced in the retro pubic space, and perforating the abdominal fascia, such as in female sling procedures. See, Joseph J. Kaufman and Shlomo Raz, *Urethral compression procedure for the treatment of male urinary incontinence*, Journal of Urology 121: 605-608 (1979).

Cystocele is a condition in which, due to laxity of the pelvic floor, the bladder extrudes out and downwards. The severity of this bladder collapse is rated between grades 1-4. In grade four cystocele, the bladder extrudes out of the vaginal opening. The treatment of choice

for this condition includes the reduction or closing of the pelvic floor opening from which the bladder descends using sutures.

As background to the inventions of the present application, further information is provided in the following publications, the disclosures of which are fully incorporated herein by reference: Eddie H.M. Sze, M.D and Mickey M. Karrara, M.D., *Transvaginal repair of vault prolapse: a review*, *Obstetrics & Gynecology* 89(3): 466-475 (1997); Shlomo Raz, M.D., *Female Urology*, Chapter 29 (Pathogenesis of Cystocele), Chapter 43 (Uterine Prolapse), Chapter 44 (Enterocèle and Vault Prolapse); Joseph J. Kaufman and Shlomo Raz, *Urethral compression procedure for the treatment of male urinary incontinence*, *Journal of Urology* 121: 605-608 (1979); Robert Cox and Peter H.L. Worth, *Results of Treatment of Post-Prostatectomy Incontinence Using the Kaufman Prosthesis*, *Eur. Urol.* 12: 154-157 (1986); Olavi A. Lukkarinen, Matti J. Kontturi, et al., *Treatment of Urinary Incontinence with an Implantable Prosthesis*, *Scan. J. Urol. Nephrol.* 23: 85-88 (1989); Sender Herschorn and Sidney B. Radomski, *Fascial Slings and Bladder Neck Tapering in the Treatment of Male Neurogenic Incontinence*, *J. Urology* 147: 1073-1075 (1992); Gene R. Barrett, M.D. Stephen H. Treacy, M.D. and Cynthia G. Ruff, M.S., *Preliminary Results of the T-Fix Endoscopic Meniscus Repair Technique in an Anterior Cruciate Ligament Reconstruction Population*, *Arthroscopy: The Journal of Arthroscopic and Related Surgery*, 13: 218-223 (1997).

### **Summary of the Inventions**

In one embodiment, the present invention relates to apparatus and methods for treatment of male incontinence and a method for female cystocele repair in which a sling

material is positioned between the descending rami of the pubic bone. In such an operation a "hammock-like" sling material is positioned below the urethra in males, or below the posterior bladder wall in the case of cystocele in females.

In the male case, this sling applies passive compression against the bulbar urethra. The compression, either by itself or in conjunction with urethral mobility, prevents urine leak during strain. If additional passive pressure is required on the urethra after surgery is completed, collagen or other bulky material can be injected with a tiny needle through the perineum, causing more pressure created by the bulky material held on one side (the lower side) by the sling, and on the other side compressing the urethra.

In another embodiment of the invention, an especially flat shaped balloon is positioned between the sling material and the urethra to provide desired compression. Examples of inflatable balloon devices are disclosed in the currently pending U.S. Patent Application entitled *Systems for Percutaneous Bone and Spinal Stabilization, Fixation and Repair*, (serial number to be assigned), filed March 6, 1998 by Mordechay Beyar, Oren Globerman and Elad Magal, the disclosure of which is fully incorporated herein by reference. This balloon is inflated with fluid, and the volume can be adjusted by inflation or reduction of the fluid inside the balloon, using a tiny needle inserted through the perineal area. In a further embodiment of the invention, the sling material is part of the flat balloon. The sling material and the balloon can either be an integral single unit, or the sling material can be attached or secured to the balloon. Inflation and deflation of the balloon, in conjunction with the sling (which is preferably secured using suitable bone anchors and suture), is used to correct the urinary pathology, in accordance with the methods disclosed herein. The sling is attached to the bone

by means of bone anchors.

In another embodiment of the invention, T-anchors and anchor inserters are provided herein. The anchors and inserters are designed for use with gynecological and urological procedures, including, but not limited to, bladder neck suspension, sacrospinous ligament procedures for the treatment of vaginal vault prolapse, and sling procedures for the treatment of urinary stress incontinence and cystocele repair.

Further disclosure of the surgical procedures in the sling procedure are provided below.

#### **Brief Description of the Figures**

Figure 1 is a plan view of a first embodiment of a T-inserter<sup>TM</sup>, in accordance with the present invention.

Figure 2 is a plan view of a first embodiment of a T-anchor<sup>TM</sup>, in accordance with the present invention.

Figure 3 is a plan view of a second embodiment of a T-inserter<sup>TM</sup>, in accordance with the present invention.

Figure 4 is a plan view of a second embodiment of a T-anchor<sup>TM</sup>, in accordance with the present invention.

Figure 5a-c are plan views of a third embodiment of a T-inserter<sup>TM</sup>, in accordance with the present invention.

Figure 6 is a plan view of the third embodiment of the T-inserter<sup>TM</sup>, after release of a T-anchor<sup>TM</sup> therefrom.

Figure 7 is a perspective and enlarged view of a T-anchor™, in accordance with the present invention.

Figures 8a and 8b are plan views of the first and second embodiments of the T-inserter™, with the threaded anchor loaded into the tip of the inserter's tube up to the anchor's midpoint, so that the suture loop is located outside of the tube.

Figure 9 is cross sectional view of the second embodiment of the T-inserter™, with the anchor having attached suture thread loaded thereon.

Figure 10 is a sectional view showing the placement of a fascial anchor inserter and an anchor in accordance with the procedure for bladder neck suspension of the present invention.

Figure 11 shows two sectional views of the placement of a fascial anchor inserter and an anchor in accordance with the procedure for sacrospinous fixation of the present invention.

Figure 12 is a view of an exposed pelvic bone showing the schematic location of the bone anchors and sling material using in a male sling procedure in accordance with the present invention.

#### **Detailed Description of the Invention and the Preferred Embodiments**

##### *Fascial "T-Anchors" For Sacrospinous Fixation*

In accordance with the present invention, fascial anchor or screw devices are provided herein for fixation of soft tissue to soft tissue. These "T-Anchors" are positioned on a special delivery system, either straight or curved. They can be either absorbable or non-absorbable.

The anchors and inserters of the present inventions are designed for use with gynecological and urological procedures. The T-Anchor system is particularly designed for

soft tissue fixation in sacrospinous ligament fixation procedures, for the treatment of vault prolapse, uterine prolapse, or prevention of vault prolapse. In such cases, the posterior wall of the vagina is opened, the sacrospinous ligament is palpated with a finger or is observed visibly, and the anchor (which is loaded on a long delivery system) is positioned on the sacrospinous ligament and pushed to perforate the ligament. Once perforated, the anchor is released, the delivery system is removed, and the suture is used to approximate the posterior vaginal wall and surrounding tissue. It is also possible to affix the suture, which is attached to an anchor positioned below the sacrospinous ligament, to the uterus.

One embodiment of the T-anchor inserter of the present invention is disclosed in Figure

1. The anchor inserter is particularly designed for soft tissue fixation in bladder neck suspension and sling procedures for the treatment of urinary stress incontinence and for cystocele repair. The inserter has a handle 20 and a body 24. Body 24 extends perpendicular from handle 20. Extending from body 24 is tube or needle 28. Tube 28 is a curved anchor deployment tube, preferably constructed from stainless steel. The tube 28 is preferably of a narrow diameter such that it can be easily inserted into and manipulated within the vaginal canal for precise positioning of an anchor therein.

At the end of tube 28 is an anchor guide for holding an anchor, the anchor guide being at the distal end of the tube 28. In one embodiment of this guide, the outer end of the anchor guide can be formed as a thin-walled tube or bore, the bore receiving an anchor therein for securing the anchor to the inserter. In one preferred embodiment, the tube curves such that the end of the tube points back towards the inserter handle 20, or approximately to the handle of the inserter, and/or the distal end of the tube 28 is approximately parallel to the inserter

body 24.

Handle 20 further includes a release button or trigger. Upon activation of the release button, the anchor is deployed from the inserter device. In the preferred embodiment, the anchor is designed for ejection from the inserter device to penetrate into soft tissue. The inserter is preferably constructed as a stainless steel tube 28 in which a plunger is positioned, such that upon pressing the release button, the plunger pushes the anchor out of the tube 28 and into the tissue. In addition to a release trigger, it is preferred that handle 20 further include a safety lock, to prevent premature ejection or release of the anchor.

In the preferred embodiment, straight anchors 32 are used with this inserter, each of the anchors being approximately 15 mm in length and 1.4 mm in diameter with a tapered end and a bore in the middle of the anchor for threading a suture thread therethrough. Each anchor is preferably made of Titanium or biocompatible plastic and is threaded through its bore with a non-absorbable suture such as braided polyester or polypropylene no. 0-1.

A second embodiment of the T-inserter of the present invention is shown in Figure 3. This embodiment of the inserter is particularly designed for the sacrospinous ligament fixation procedures in accordance with the present invention. T-inserter 40 includes a handle 42 having a release button or trigger means 44. In the preferred embodiment, the T-inserter further includes a safety means for preventing accidental or premature release of an anchor from the T-inserter. Attached to the handle of the T-inserter is a straight tube or needle 46. At the end of tube 46 is an anchor guide for holding an anchor 48, the anchor guide being at the distal end of the tube, as shown in Figure 9. In one embodiment of this guide, the outer end of the anchor guide can be formed with a bore, the bore receiving an anchor therein for

securing the anchor to the inserter.

In the preferred embodiment, each of the anchors 48 for use with the T-inserter of Figure 3 are approximately 11 mm in length and 1.5 mm in diameter, with a tapered end and a bore in the middle for threading the suture therethrough. The anchors are made of absorbable/resorbable materials such as Poly-1-lactide, and are threaded with an absorbable suture such as Vicryl suture no.0-1.

A further T-inserter 50, in accordance with the present invention, is shown in Figures 5 and 6. The T-inserter 50 includes a handle 52, a body 54, and a tube or needle 56. The inserter further includes a rigid segment or safety lock 58. This inserter is similar in its features to the inserters described above. In inserter 50, however, a different release technique is used. Handle 52 consists of a scissor or pincer like design in which handle 52 is separated into two separate segments or halves 52a and 52b, both connected at joint 60.

To use the inserter, an anchor with suture thread is inserted into the distal end of the tube 56, as described above. During the positioning of the inserter 50 within the body, safety lock 58 is kept in place to restrain handle segments 52a and 52b from movement, as shown in Figures 5b and 5c. When the inserter is in place, such that the distal end of tube 56 is correctly positioned with the distal end located at the proper point of anchor insertion, safety lock 58 is released as shown in Figure 5a. Upon release of the safety lock 58, handle segments 52a and 52b can be squeezed together to cause a plunger to push through tube 56, pushing against the rear of an anchor to be released from the distal end of the inserter device, as shown in Figure 6.

As described above, T-anchors for use in accordance with the present invention are

disclosed in Figures 2 and 4. A further illustration of the T-anchor of the present invention is provided in Figure 7. As shown in Figure 7, anchor 60 consists of a basically cylindrical body 63 having a tapered end 66, a blunt end 68 and a bore 64 (in the preferred embodiment, extending perpendicularly to the longitudinal axis of the anchor) for receipt of a threaded suture 62 therethrough.

With the inserters of Figures 1, 3, and 5, and in accordance with the procedure of the present invention, approximately half the length of a suture is threaded through the bore of an anchor. As a result, the bore of the anchor, as shown in Figures 2, 4 and 7, sits midway on the strand of suture. Holding the threaded anchor at the tapered end 66, the blunt end of the anchor 68 is pressed into the bore at the tip of the inserter tube or needle. The threaded anchor is pushed backwardly into the tip of the inserter's needle up to the anchor's midpoint, so that the suture loop is outside of the tube 28, as shown in Figures 8a and 8b. Alternatively, the sides of the tube 28 can be provided with bayonet slots for accommodating the suture extending therethrough, with the anchor then being able to be fully recessed into the tube.

#### *Bladder Neck Suspension Procedure with T-Anchor System*

In accordance with the invention, to perform a bladder neck suspension procedure, it is preferred that the anchor inserter of Figure 1 be used. Once the patient has been placed under anesthesia, and is in the lithotomy position, a foley catheter is inserted into the bladder and the balloon is inflated. As shown in Figure 10, the inserter is inserted through the anterior vaginal wall, lateral to the urethra, and is advanced along the posterior surface of the pubic bone, until the device's tip passes the abdominal fascia just above the superior pubic ramous.

The safety lock on the inserter is then released, and the anchor is deployed, by pushing on the trigger of the inserter, into tissue. The inserter device is then removed from the vaginal canal, and the suture of the anchor is pulled to securely hold the anchor in the tissue. By pulling on the suture attached to the center of the anchor, the anchor assumes a parallel orientation relative to the fascial layer.

The procedure is then repeated on the contralateral side, and cystoscopy is performed to verify bladder and urethral integrity. At this point, anchor fixation to the abdominal fascia has been achieved and the vaginal suspension, using the free ends of the suture thread, is continued according to one of the procedures known in the art, including such procedures as the Raz, Pereyra, Gittes or sling procedure.

#### *T-Sacrospinous Fixation Procedure*

In accordance with the present invention, a T-Sacrospinous fixation procedure is further provided herein, as shown in Figure 11. An T-anchor™ is threaded with suture and loaded onto the anchoring device of Figure 3. With the patient under anaesthesia and in the lithotomy position, the surgical area and the vagina are disinfected. The posterior vaginal wall is opened, the rectum is pushed to the left, and the sacrospinous ligament is palpated. Palpating the ligament with a finger, the inserter is advanced along the finger until the tip of the anchor perforates the sacrospinous ligament. The insertion lever is then pressed (after disengaging the safety), causing the anchor to be deployed in the sacrospinous ligament, resulting in a firm attachment to the ligament. The inserter is then pulled out, and the suture is pulled for proper anchoring as disclosed above. The procedure is then repeated on the

contralateral side. Colporrhaphy is then performed.

In accordance with additional inventions of the present application, a variety of further surgical procedures using bone screws to correct urological and gynecological pathologies are further disclosed below. The disclosures of U.S. Patent Application Serial Nos. 08/733,798 (filed Oct. 18, 1996) and 08/804,172 (filed Feb. 21, 1997), relating to bone anchors and inserters, including bone screw and screw inserters, are fully incorporated herein by reference.

#### *Sling Procedure for Male Incontinence Using Pubic Bone Anchors*

In accordance with one invention, a sling procedure is disclosed herein for treatment of male incontinence, and in particular for treatment of patients suffering from post-prostatectomy incontinence. For the procedure to be performed, the patient should have no urethral obstruction or any pathology involving the bulbar urethra. In this embodiment, bone anchors are used to suspend a sling material below the bulbomembranous urethra.

In accordance with the invention, the patient is first placed in the lithotomy position. After preparation and draping, a 16Fr. Foley catheter is inserted into the urethra, and the scrotum is elevated. A vertical incision is made over the midline in the perineum. The skin and subcutaneous tissues are dissected free. The bulbocavernous muscle is then exposed and dissection is carried out posteriorly to the area of the transverse perineum to completely free the bulbar urethra. Lateral dissection is used to expose the corpora cavernosum.

Upon exposure of the corpora cavernosum, four bone screws or anchors are inserted in the inner portion of the descending rami of the pubic bone using a straight screw or anchor

inserter. Each bone screw is loaded with No. 1 Prolene sutures. The first pair of bone screws is inserted just below the symphysis, while the second pair is inserted at the level of the ischial tuberosity.

When insertion of the second pair has been completed, a template is obtained from the bulbar urethral area and is measured. A segment of synthetic material or cadaveric or autologous fascia is fashioned over the template to create a sling. The four corners of the sling are then transfixated with the preloaded Prolene suture at each end. One side of the sling is tied tight over the pubic bone while in the contralateral side the tension will be adjusted. An example of the adjusted anatomy at this point, with the anchors and sling in place, is shown in Figure 12.

The Foley catheter is then deflated and removed. The Foley catheter is connected to a sterile saline perfusion line. A zero pressure state is obtained by lowering the bag to the level of the symphysis. The tip of the catheter is repositioned at the penoscrotal angle and the urethral resistance to start the flow is recorded (by distance above the zero line). In patients under anesthesia suffering from sphincter incontinence, the resistance is very low. Tension is then applied to the untied side of the sling, and the pressure is adjusted to increase urethral resistance between 30 and 60 cm water. The second pair of sutures are then tied to the selected degree of tension.

The Foley catheter is then advanced to the bladder (which should advance without difficulties), and the wound is irrigated with Bethadine solution and closed in layers. Subsequently, the Foley catheter is removed after 2 hours, and the patient can be discharged home on oral antibiotics and pain medication.

### *Repair of Grade Four Cystocele Using Retropubic and Lateral Pubic Bone Anchors*

In accordance with another invention of the present application, a method is provided for repair of cystocele using retropubic and lateral pubic bone anchors. This surgery is indicated for patients with grade four cystocele and urethral hypermobility. The procedure repairs the central defect, the lateral defect, approximates the cardinal ligaments to the midline, and creates a sling of the urethra.

After preparation and draping, a Foley catheter is inserted in the bladder. Once the catheter is in place, a "goal post" incision is made. The vertical bars of the goal post extend laterally from the distal urethra to the horizontal bar that is made just proximal to the bladder neck. The vertical bars reach the vaginal cuff.

After creation of the goal post incision, the vaginal wall is dissected free to expose the perivesical fascia laterally and the cardinal ligaments posteriorly. A figure eight 2-0 absorbable suture is applied to approximate the cardinal ligament to the midline without tying it. If an enterocele sac is encountered, it should be repaired at this stage.

The retropubic space is then entered over the periurethral fascia at the level of the vertical bars of the incision, and the urethropelvic ligaments are exposed. Two fascial anchors (the upper pair) are inserted into the tissue of the suprapubic area. Each of these anchors contains a preloaded No. 1 Prolene suture.

In an alternative embodiment, at this stage of the procedure, the retropubic space is not open and two bone anchors are applied to the inner surface of the symphysis using a right angle drill.

After application of the first set of anchors, a second pair of bone anchors or screws is

applied to the inner surface of the descending rami of the symphysis. These anchors (the lower pair) also have No. 1 Prolene sutures preloaded in the bores of the screws.

Once the four anchors are in place, the bladder prolapse is reduced using a moist sponge over a right angle retractor. Alternatively, a Dexon mesh is applied and left in place. The lower pair of Prolene sutures are then used to incorporate the perivesical fascia and the cardinal ligaments area. Interrupted 2-0 absorbable sutures are used to approximate the perivesical fascia to the midline over the Dexon mesh.

The transverse segment of the goal post incision is then dissected free to create a groove or tunnel for the sling to be embedded or inlayed into. A synthetic rectangular sling or, alternatively, an autologous or cadaveric segment of fascia (of approximately 6 by 2 cm) is used to create the urethral sling. The end of the sling is transfixated with the upper pair of Prolene suture. Cystoscopy is performed after injection of indigocarmine to ensure ureteric patency, bladder integrity, and normal positioning of the sling.

Once the sling has been properly positioned, and ureteric patency and bladder integrity have been verified, the perivesical and cardinal ligament sutures are tied to close the central defect. The lateral defect suture is tied without tension.

The sling sutures are then tied over a cystoscope sheath at a 30 degree angle to avoid obstruction. The excess of the vaginal wall is excised, the vaginal wall is closed with running sutures, and a packing is inserted for 2 hours.

#### *Transvaginal Repair of Enterocèle Using Fascial Anchors*

In a further invention, a procedure for transvaginal repair of enterocèle using fascial

anchors is provided herein.

In accordance with the invention, the patient is first placed in the lithotomy position.

During preparation and draping, a rectal packing is inserted to facilitate the surgical procedure. A Foley catheter or suprapubic catheter is inserted to drain the bladder, and a ring retractor with six hooks is used to expose the vaginal canal.

The vaginal cuff is then held with Allis clamps and a vertical incision is made. The vaginal wall is dissected free, exposing the enterocele sac. The hooks of the ring retractor are used to hold the vaginal wall internally. Once the vaginal wall is securely held, the enterocele sac is dissected free, exposing posteriorly the pre rectal fascia and anteriorly the bladder wall. The enterocele sac is then opened, exposing the peritoneal contents. A large moist pad is inserted in the peritoneal cavity and a deep right angle retractor is used to elevate the anterior segment (bladder). The small bowel or distal colon is pushed away from the operating field.

A deep posterior retractor is then inserted posteriorly to displace the rectum laterally to the left side exposing the right pararectal area. By sliding a finger over this space, the soft levator musculature can be felt, and, just posteriorly, the hard surface of the coccygeus muscle and sacrospinous ligament, running from the ischial spine to the sacrum.

Using a straight fascial anchor and under finger control, two absorbable anchors are inserted through the right sacrospinous ligament 2-3 cm medial to the ischial spine. Each of the anchors are preloaded with suture, such that the sutures are threaded through the anchor, and can slide through the anchor freely when pulling on only one end. The strength and fixedness of each anchor's insertion is tested by a strong pull on both ends of the anchor's sutures.

At the deepest point of the vagina, one free end of the sutures is used for threading through a good sized portion of vaginal wall, and the end is then transferred to the vaginal lumen. Then the other end of the suture is likewise also transferred to the vaginal lumen, at a distance of approximately 1 to 2 cm from the prior suture.

Two sequential purse string sutures of No. 1 Vycryl are then used to close the peritoneal cavity. The suture includes the pre rectal fascia, the sacrouterine and cardinal ligaments, and the perivesical area. Alternatively, a Dexon mesh can be included with the last suture to reinforce the closure of the cul de sac. The sutures are tied and the excess of peritoneum is excised.

The pre rectal fascia is then closed using a running absorbable suture. The excess of vaginal wall is excised, and the vaginal wall closed with a running suture. The sacrospinous sutures are tied individually with the help of a right angle retractor, making sure that the vaginal dome slides tension to the anchoring point deep in the vagina.

A vaginal packing is then inserted for 2 hours and the patient can be discharged home after recuperation from anesthesia.

*Sling Procedure Using Fascial Anchors (Using Synthetic Material, Cadaveric or Autologous Fascia)*

In a further invention, a sling procedure using fascial anchors (using synthetic material, cadaveric or autologous fascia) is provided herein. This technique is a vaginal sling procedure which provides treatment of stress incontinence in patients with minimal or mild urethral mobility (intrinsic sphincter deficiency).

In accordance with the invention, the patient is first placed under general, spinal or local anesthesia with controlled sedation. Once anesthetized, two oblique incisions are made in the anterior vaginal wall. The vaginal wall is dissected laterally over the periurethral fascia.

Using Mayo scissors and pointing toward the ipsilateral shoulder, the retropubic space is entered in each side. The urethropelvic pelvic ligament is detached creating a small window in the retropubic space, the window being large enough to pass two fingers. The retropubic space is then freed from adhesions.

Under careful finger control, the curved fascial anchor is passed from the vaginal to the suprapubic area. The tip of the instrument is pointed just above the periostium of the superior rami of the symphysis. It is strongly recommended to transfer the anchor as close to the pubic bone as possible in order to minimize suprapubic pain.

Keeping this guideline in mind, a fascial anchor having a No. 1 Prolene suture is inserted in the suprapubic area. After fixation of the anchor, the ends of the anchor's sutures are pulled on to verify that the anchor has been strongly fixated into the tissue. A total of two anchors are inserted. The free end of the Prolene sutures will be used to support the fascial sling.

A segment of sling 7 to 8 cm by 2 cms in size is then obtained. Various options are available for the sling material. The sling can be made from cadaveric or autologous fascia (from the abdominal wall or fascia lata). Or, if desired, the sling can be made from any FDA approved synthetic material.

One of the Prolene sutures is used to firmly anchor one end of the sling. Several passes of the needle over the tissue is recommended. It is important for the sling to slide freely from

the suture.

Using a long beak right angle clamp, a tunnel is made underneath the vaginal wall at the level of the bladder neck. Using a free suture as a guide, the sling is transferred beneath the vaginal wall to the contralateral side. As an alternative in difficult cases, a transverse incision is made at the level of the bladder neck and the sling is transferred to the contralateral side.

In a similar fashion, the second Prolene suture in the contralateral side will include the other side of the sling, while ensuring that the sling can freely slide from the suture.

Cystoscopy is performed in order to assure bladder integrity and good positioning of the sling. By the nature of the procedure, there is no need to check for ureteric efflux. A suprapubic catheter is inserted for drainage and its position is controlled during the cystoscopy.

The Prolene sutures are then tied sequentially after inserting a cystoscopy sheath into the urethra at a 30-degree angle. Alternatively, a clip applier can be used, obviating the need for suture ties. The vaginal wall is closed with a running 2-0 Vycryl suture. After two hours, the vaginal packing is removed and the suprapubic catheter is plugged. The patient is instructed to check post void residuals every 2-3 hours or as required by the urgency to urinate. The patient can be discharged home after 4-6 hours on a regular diet, oral antibiotics and pain medication. The patient can resume normal activities (walking, standing, sitting, etc.) as soon as they feel comfortable. Impact exercise or heavy lifting should be avoided for one month. The suprapubic catheter is removed as soon as the residuals of urine are less than 60 cc.

### *Vaginal Wall Sling Using Facial Anchors*

In a further invention, a vaginal sling procedure is provided herein for the treatment of stress incontinence in patients with mild to moderate cystocele (lateral defect only).

In accordance with the invention, under general, spinal or local anesthesia with controlled sedation, two oblique incisions are made in the anterior vaginal wall. The vaginal wall is dissected laterally over the periurethral fascia. Using Mayo scissors and pointing toward the ipsilateral shoulder, the retropubic space is entered in each side. The urethropelvic pelvic ligament is detached, creating a small window in the retropubic space sufficiently large to pass two fingers. The retropubic space is then freed from adhesions.

Under careful finger control, the curved fascial anchor is passed from the vaginal to the suprapubic area. The tip of the instrument is pointed just above the periostium of the superior rami of the symphysis. It is strongly recommended to transfer the anchor as close to the public bone as possible in order to minimize suprapubic pain.

A fascial anchor having a No. 1 Prolene suture is then inserted into the tissue of the suprapubic area. After inserting the anchor into the tissue, the ends of the sutures are pulled down to ensure that the anchor has been securely fixed into the tissue. A total of four anchors are fixed in the tissue, in all. The free end of the Prolene sutures will be used to support the anterior vaginal wall.

The first suture will include the perivesical fascia and medial edge of the urethropelvic ligament at the level of the bladder neck. The second suture will include the urethropelvic ligament (midurethral complex), the edge of the urethropelvic ligament, and the periurethral fascia.

The same maneuver is then performed in the contra lateral side.

Once these steps have been completed, cystoscopy is performed in order to ensure bladder integrity and good efflux of urine from the ureteric orifices. A suprapubic catheter is inserted for drainage and its position is controlled during the cystoscopy. The Prolene sutures are then tied sequentially after inserting a cystoscopy sheath into the urethra at a 30 degree angle. Alternatively, a clip applier can be used, obviating the need for suture ties.

The vaginal wall is then closed with a running 2-0 Vycryl suture. After two hours, the vaginal packing is removed and the suprapubic catheter is plugged. The patient is instructed to check post void residuals every 2-3 hours or as required by the urgency to urinate. The patient can be discharged home after 4-6 hours on regular diet, oral antibiotics and pain medication. The patient can resume normal activities (walking, standing, sitting, etc.) as soon as they feel comfortable. Impact exercise or heavy lifting should be avoided for one month. The suprapubic catheter is removed as soon as the residuals of urine are less than 60 cc.

#### *Supporting the Vaginal Cuff During Vaginal Hysterectomy Using Fascial Anchors.*

In a further invention, a technique for supporting the vaginal cuff during vaginal hysterectomy using fascial anchors is also provided herein. This technique is recommended for closure of the vaginal cuff at the time of vaginal hysterectomy for prolapse. It is aimed at preventing prolapse of the vaginal cuff, preservation of vaginal depth and restoration of the normal vaginal axis.

Once the hysterectomy has been completed, marking sutures are left in place at the

sacrouterine-cardinal complex, uterine artery and broad ligaments, and the peritoneal sac is left open. A large moist pad is inserted in the peritoneal sac and retracted with a deep right angle retractor. The small bowel or distal colon is pushed away from the operating field.

A deep posterior retractor is inserted to displace the rectum to the left, exposing the right pararectal area. Sliding a finger over this space the soft levator musculature is felt, and just posteriorly, the hard surface of the coccygeus muscle and sacrospinous ligament, running between the ischial spine and the sacrum.

Using a straight fascial anchor and under finger control, two absorbable anchors are inserted through the right sacrospinous ligament, 2-3 cm medial to the ischial spine. The strength of the anchor is tested by a strong pull on the sutures that are preloaded. The sutures should slide freely.

At the deepest point of the vagina, one free end of the suture is used for threading through a good sized segment of the vaginal wall. This free end of the suture is then transferred to the vaginal lumen. The other end of the suture is also threaded through the vaginal lumen, at a distance of 1 to 2 cm from the prior suture.

Two sequential purse string sutures of No. 1 Vycryl are then used to close the peritoneal cavity. The suture includes the pre-rectal fascia, the sacrouterine and cardinal ligaments, and the perivesical area. Alternatively, a Dexon mesh can be included with the last suture to reinforce the closure of the cul de sac. The sutures are tied and the excess of peritoneum is excised.

The broad ligament sutures are then tied together in the midline. Then the uterine artery sutures and the sacrouterine ligament sutures are cut. The vaginal cuff is closed in a

transverse fashion with running locking sutures. The rest of the vaginal reconstruction is performed as indicated.

*Repair of Vaginal Vault Prolapse Using Fascial Anchors*

In a further invention, a technique for repair of vaginal vault prolapse using fascial anchors is also provided herein. A similar technique can be used to support the uterus and vaginal cuff in cases of severe vault prolapse. No hysterectomy or opening of the peritoneum is required.

This surgery is similar to the enterocele repair. A vertical incision is made over the posterior and superior vaginal wall. The dissection is carried out laterally to enter the extraperitoneal pararectal space, toward the coccygeus muscle (above levators, beneath peritoneum and lateral to the rectum). The sacrospinous ligament is felt as it attaches to the ischial spine. Two fascial anchors are applied 2-3 cm medial from the spine. The end to the sutures is used to anchor the vaginal wall in a similar fashion, as described above. After closing the vaginal wall, the sutures are tied, making sure that the vaginal wall slides easy to the anchoring point.

Having described this invention with regard to specific embodiments, it is to be understood that the description is not meant as a limitation since further modifications and variations may be apparent or may suggest themselves to those skilled in the art. It is intended that the present application cover all such modifications and variations.